# AGRICULTURAL Research

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## Versatility in DAS

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AGRICULTURAL
# Research

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*Editor: H. G. Hass. Managing Editor: J. R. Madison. Contributors to this issue: D. H. Mayberry, W. W. Martin, M. T. York, G. M. Jones, W. E. Carnahan, D. W. Goodman, R. T. Prescott, N. E. Roberts.*



## Pork

At no time has the need for improvement in swine breeding practices been greater nor the prospects for advances in breeding appeared brighter.

Pork has traditionally been an inexpensive meat, important in the diet as a source of thiamine. There has recently been a downward trend in pork consumption relative to consumption of other meats. Consumers are discriminating against overly fat pork, and the market for cooking lard has largely disappeared. Many management and breeding innovations have improved beef and poultry, chief competitors of pork.

These facts emphasize the importance of developing and applying breeding and testing procedures that will improve acceptability of pork and the efficiency of producing it.

Research has shown that selection based on objective performance records and the choice of correct breeding plans are the principal ways for achieving the greatest and most rapid improvement of breeding stock. Record of performance programs should be promoted in a nationwide effort.

Research has also supplied information on the heritability and genetic correlation of different economic traits, thus adding precision to estimates of the rate of improvement that can be expected from careful selection of breeding stock.

Carcass quality characters are among the highly heritable traits. They can be expected to respond rather quickly to careful selection. Meat-type hogs have a higher percent of weight in the five preferred cuts, and they also tend to be more efficient in the feedlot and to produce larger litters than fat hogs.

Much remains to be done. Recently gained genetic knowledge has not been fully exploited. Researchers are studying breeding systems and selection methods to guide producers.

Blood-typing may help researchers judge more accurately the productive potential of swine. Basic studies of artificial insemination and the nature of variations in litter size are other areas of investigation. It is in these areas that there will be progress toward improving the quality and economy of pork production.

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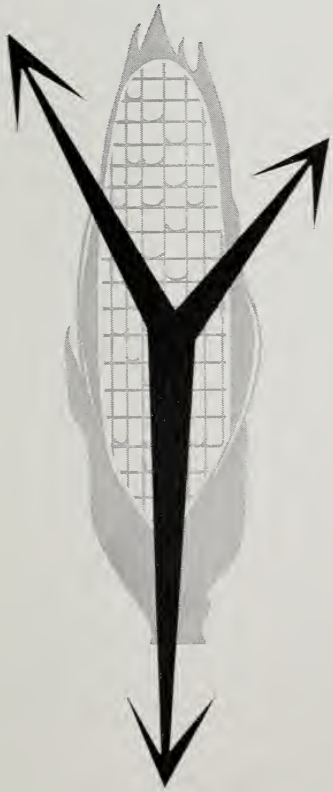
Growth Through Agricultural Progress

**AGRICULTURAL RESEARCH SERVICE**
**United States Department of Agriculture**

Dialdehyde starch, an industrial chemical made from corn, can be used in making various products

# *Versatility in* DAS



■ Dialdehyde corn starch (DAS), an industrial chemical developed by USDA utilization scientists, is showing potential value for an increasing variety of commercial applications.

The two latest experimental applications of DAS result in improved paper coatings and insulating board. In addition, ARS and industry research shows that DAS can be used in making:

Additives to increase wet strength of paper; coatings for glass, metal, or wood that resist boiling water and organic solvents; compounds potentially useful as paper-coating adhesives and textile sizes—or as thickening agents in products as different as cosmetics and oil-drilling muds; chemicals—for example, erythritol, which can be converted into an explosive or used in pharmaceuticals; pretanning agent for leather; and sheets of tobacco.

Industrial application of these developments would not be feasible without the low-cost process for making DAS developed at the ARS Northern utilization laboratory in Peoria, Ill. All but two of the applications were also developed there. Research on DAS as a pretanning agent for leather was done at the Eastern utilization laboratory, Wyndmoor, Pa. Research on using it as an adhesive in reconstituted tobacco sheets for cigars was done by industry.

The full commercial potential of DAS will not be realized until industry begins buying it in volume. Then the low-cost ARS method can be used to supply large quantities of DAS at a desirable price.

Dialdehyde starch is made by oxidizing starch with an iodine derivative, periodic acid. Prior to development of the low-cost process, almost $300 worth of periodic acid (current price) would have been required to oxidize 10 pounds of starch, worth about 60 cents. In the new process, which electrolytically converts crude iodine to periodic acid and continually regenerates the acid after use, only 10 cents worth of crude iodine is required to process 10 pounds of starch.

The new paper coatings resulted after DAS was used to make the coating adhesive, casein, water-resistant. Coatings were made with wet-rub resistance equal to that of label coatings, the best grade available commercially. Coatings that don't rub off when wet also are needed for offset-printing and container stocks.

Insulating board made from a 75–25 percent pulp blend of sugarcane bagasse and used newsprint, with 2.5 percent DAS (by weight) added, was 10 times as strong as test board without the chemical. Using DAS and reducing the amount of newsprint, the Peoria scientists cut the drainage time for one pulp blend. The resulting board was less dense, and equally as strong as board made from slower draining pulp.

Experimental paper containing 0.5 to 1 percent of DAS had sufficient wet strength for most uses. Some treated papers were more than eight

*Turn Page*

## DAS

(*Continued*)

times stronger than untreated ones. Wet-strength paper is used for toweling, tissues, outdoor posters, shipping sacks, grocery bags, food wrappers, and photographic and filter papers. About 2.4 million tons of wet-strength paper are used annually in the U.S.

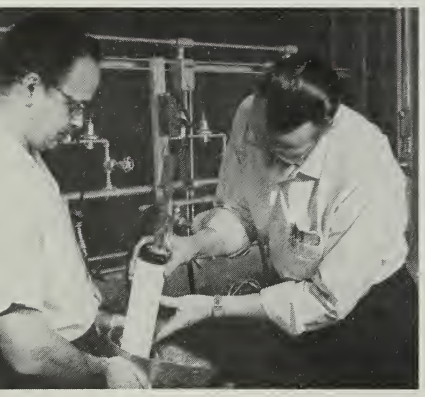
Coating materials are formed by reacting DAS with alcohols to produce compounds (acetals), which can be applied to glass, metal, or wood, and heat-cured to a finish 64 percent as hard as plate glass. The best coating resisted boiling water 10 hours and was undamaged after 30 days in dilute sulfuric acid.

Thickening agents for products such as cosmetics and oil-drilling mud might come from dicarboxyl starches made from DAS. The dicarboxyl starches are useful, because they don't gel when cooled.

Gum-like compounds similar to the dicarboxyls might be used as paper-coating adhesives or textile sizes. These compounds are made by reacting DAS with chlorine in methanol.

A research contractor demonstrated that shoe sole leather can be made in half the usual processing time, if DAS is used as a pretanner.☆

*Annular (electrolytic) cell makes DAS at low cost in pilot plant.*



**Fifth in a Centennial Series**

# FOOD

*Utilization scientists have done much in developing economical, attractive, and convenient processed foods*

■ Out of the kitchen and into the processing plant has gone much of the peeling, slicing, squeezing, boiling, baking, and frying connected with food preparation, thanks in part to ARS utilization research.

Now farmers have reliable processing outlets for foods, in addition to the fresh market, and housewives have more leisure time.

USDA has a 100-year history of research on foods. In 1940, much of this work was shifted into new utilization laboratories in Wyndmoor, Pa., Peoria, Ill., New Orleans, La., and Albany, Calif. Since then, scientists in these laboratories have been developing new processed foods that are economical, attractive, and above all, convenient.

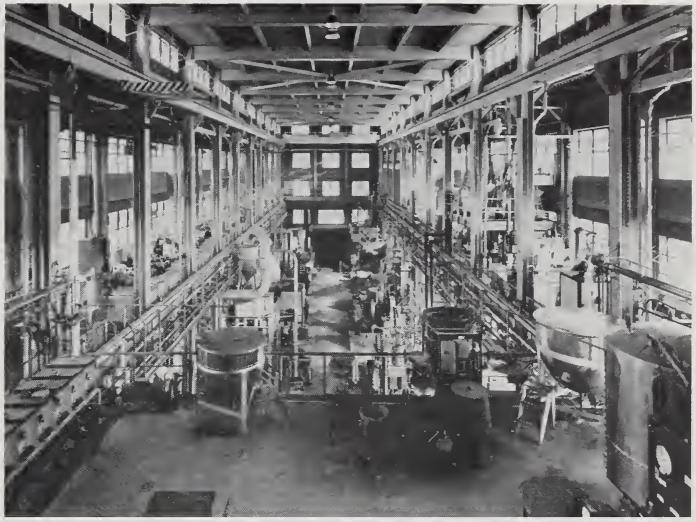
An outstanding success is frozen concentrated orange juice. It was developed in 1943, in cooperation with the Florida Citrus Commission, in a laboratory in Winter Haven, Fla. This laboratory is now part of USDA's Southern utilization division. Last year, consumers spent more than $250,000,000 on frozen citrus juice concentrates, more than twice the farm value of the entire citrus crop 25 years ago.

Another utilization study showed how the volatile flavors (essence) of apple and other noncitrus fruit juices could be captured. Returning this essence to the juices after most of the water has been evaporated makes full-flavor juice concentrates.

Delicious superconcentrates, which are restored to natural strength by adding six parts of water, may be available to consumers soon. Essences have been restored in dried fruit juices to produce powders which, even after long storage, can be reconstituted as juices that possess a fresh-fruit flavor. Essences have long been used in making jellies and can be used to flavor such products as ice cream, candy, and carbonated beverages.

Dried rations used during World War II were forerunners of today's excellent prepared foods. Principles of egg dehydration, for example, worked out then made possible many prepared mixes containing eggs. Improvements in potato granules and the development of a new product,

*Frozen-food research was guide in improving handling methods.*



*Pilot-plant equipment is used for testing various experimental processing methods.*

potato flakes, have brought consumers high-quality dehydrated mashed potatoes. The industry estimates that 12 million bushels of potatoes from the 1960 crop were made into granules and flakes.

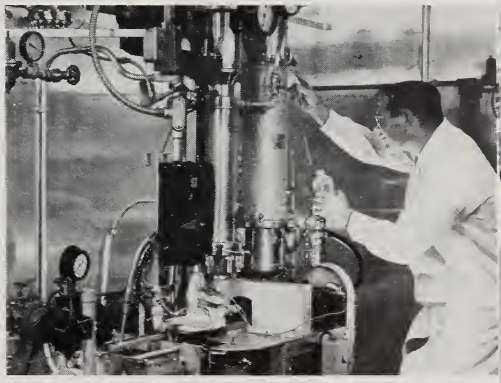
Utilization research has been prominent, especially through time-temperature-tolerance studies, in the phenomenal development of the frozen-food industry. These studies have shown the quality losses commercial frozen foods sustain when exposed for various periods to temperatures from 0° F., or lower, up to defrosting temperature. The facts obtained have guided producers, shippers, and sellers of frozen foods in the establishment of protective handling practices.

Shipping and storage economies of dehydration were combined with the flavor-holding advantages of freezing in dehydrofreezing, a process developed by utilization scientists. This process involves removal of about half the water from a food before freezing—thus reducing packaging, shipping, and storage costs. It's been used primarily on fruits and vegetables for manufacturing, apple slices for pies, vegetables for soups, and pimientoes for cheese. But dehydrofrozen foods are being exported for retail sales, and as production increases these products will appear in retail stores here.

Utilization research on flavor stability has helped make soybeans a major source of edible oils in the U.S. And ARS scientists developed new ways of processing soybeans. These methods permit the Japanese to make their traditional foods, miso and tofu, from American-grown soybeans, thus opening up another export market.

These are highlights of many contributions our scientists have made to improve foods. There are many others—better cottonseed oil, new cheese-making processes, poultry processing to increase tenderness, high-flavor maple syrup, storable shelled walnuts, and canned bacon.

Additional contributions are better beef, pork, lamb, and poultry through research on improving protein feeds, stabilizing carotene in alfalfa, and producing vitamins by fermentation.☆



*Fruit juices are reconstituted from powders, using a utilization-developed process.*

*Faster process for making miso, Japanese food, came from utilization research.*

*Researchers aren't trying to get* more *moisture from the atmosphere—they're attempting to develop ways of* saving *more of the rain and snow that falls in the West. And they have some early results that show the job can be done*

# UNDEVELOPED WATER SOURCE... the SKY

■ The West has one undeveloped water source that's neither in the ground nor in the ocean. ARS scientists say it's the sky.

These researchers are not trying to get more water from the sky. They are seeking ways to conserve more of the limited precipitation the atmosphere naturally provides.

The possibilities for developing this "water hole" are challenging. Of the 12 to 13 inches of average annual precipitation in the 17 Western States, only about 30 percent contributes to the fresh water supply. Direct runoff of this precipitation or deep percolation of it into the soil add to the water supply.

What happens to the rest? ARS soil scientist J. S. Robins says much of it evaporates from soil, water, snow, and plant surfaces. The rest infiltrates the soil and is transpired back into the atmosphere by vegetation. Saving some of this lost moisture offers the only opportunity for developing new water supplies in substantial areas of the U.S.

Efforts up to now have been devoted largely to the 30 percent of total precipitation that furnishes the water supply.

Mountain streams have been intercepted to deliver water by canal to irrigable land or urban areas. Wells have been drilled to tap underground reservoirs. The best surface and underground water sources have been developed. Future projects of this kind will probably be more expensive and less productive than those already undertaken.

Desalting saline water holds promise chiefly for areas near the ocean. Besides, present experimental desalting methods still are too expensive for widespread use in supplying water for field irrigation.

The undeveloped "water hole"—the sky—remains. And the need for more water is immediate.

### Greater supply needed throughout area

Demand for municipal and industrial water is increasing rapidly. Inadequate water supplies limit production on most of the 200 million acres of cropland, 600 million acres of rangeland, and much of the forested land in the West. Ranchers could more completely use Western grazing areas if they could provide more water for livestock.

Saving even part of the moisture that is lost by evapotranspiration (evaporation plus transpiration) would improve efficiency of water utilization and stabilize crop production. An additional inch of water for plant use could increase Western wheat production 2 to 5 bushels per acre, sorghum yields 3 to 8 bushels, and fertilized grass or corn forage production by 100 to 400 pounds of dry matter.

Two approaches to saving water are under investigation:

1. Treatment of soil, plant, or

water surfaces to restrict evaporation and transpiration.

2. Collection and storage of precipitation in arid-area watersheds. This water could be used for irrigating other land, for livestock water, or possibly for domestic uses.

Scientists are investigating chemical and mechanical methods for restricting evaporation and transpiration. They are studying plastic or mechanical barriers to control water or vapor flow to the soil surface. And they are testing chemical or physical treatments of soil to inhibit water loss.

At Tempe, Ariz., and Logan, Utah, ARS soil scientists and agricultural engineers are devising ways to collect or concentrate rainfall and melted snow from hillsides specially treated to provide maximum runoff.

Researchers at Tempe are investigating low-cost materials that can be sprayed on the soil surface. Treated soil absorbs little or no precipitation, and water collected is stored for use by crops or livestock.

### Studies indicate use of three sprays

Preliminary results indicate three separate spray applications are required: a soil sterilant to kill weeds, a soil stabilizer to prevent water infiltration into the soil, and a water-repellent chemical to control erosion. However, the scientists believe a satisfactory treatment can be developed that will cost as little as 10 cents per square yard.

ARS researchers in Utah have developed a method of concentrating water for livestock use in arid areas (AGR. RES., March 1961, p. 6). Ground covers of butyl rubber sheeting or asphalt-coated jute fabric are used to move runoff from small land areas into reservoirs or special bags.☆

*Computing data are E. L. LeClerg and Jean C. Rudelphi*

# COMPUTERS SPEED RESEARCH

A mathematician at the console of an electronic digital computer is helping USDA scientists do research on animals, plants, and soils, and in chemistry, engineering, and home economics.

Today, obtaining valid conclusions from even a simple experiment may involve hundreds of samples, thousands of observations and measurements, and many thousands of calculations. Making these calculations with a pencil and paper might take months. Even with the aid of a desk calculator, the job would still take several weeks.

That's why ARS scientists (3,200 in different parts of the world) are serviced by a small group of highly trained programmers and analysts who use a digital computer to reduce calculation time to hours. These persons are statisticians with training in the farm sciences.

Members of this group, part of the ARS Biometrical Services Staff, work at the Agricultural Research Center, Beltsville, Md. They use a computer designed especially for scientific and engineering work.

The computing laboratory is an integral part of the technical services available to ARS scientists. In addition to helping process and analyze data, biometricians help the investigators plan their experiments and evaluate research results to get the most comprehensive and reliable information possible.

Electronic computation is valuable for basic as well as applied research. In fact, it has made possible the solution of many problems in fundamental research that could not previously be tried, problems involving the simultaneous study of many variables.

For example, the computer was used to determine the effectiveness of 35 insecticides tried at various dosage levels on biting flies of different ages. The flies were living under various climatic conditions. To get valid conclusions, approximately 1,000 calculations were needed for each insecticide. Using an electronic computer, it took about 3 hours to make these 35,000 calculations. Without the computer, the job would have taken more than 5 weeks.

The computer is used also to reevaluate experiments done in the past. Preliminary results were calculated by hand, but detailed examination of all accumulated data from a single experiment, or from a series of similar experiments, had to wait for the speed of electronic machines.

Finally, data on some studies, continued for long periods of time, had accumulated faster than scientists could analyze the information. The computer is helping to unplug these research bottlenecks.☆

# KEEPING TILE DRAINS OPEN

*Two different treatments can remove minerals that clog drainage systems installed to remove excess water from fields in California*

*Deposits of manganese (above) and iron (above left) sometimes clog lines built to carry off surplus irrigation water. ARS scientists have developed ways of restoring these drains.*

■ Sulfur dioxide gas or sulfuric acid and sodium bisulfite chemical treatments can remove mineral deposits from tile drainage systems and end a serious problem for landowners in the Imperial and Coachella Valleys of California.

Deposits of manganese dioxide or iron oxide, or both, often clog tile lines installed to carry off surplus irrigation water. As deposits build up, the drains become progressively less efficient: some cease to function at all. Then the water table rises, and salts harmful to plants accumulate in the soil.

Until treatments were developed by USDA scientists, there was no practical way to restore water flow in clogged drains. New drain tiles had to be installed.

ARS chemist A. J. MacKenzie, Brawley, Calif., developed the gas method, which is easier than the other method and requires less labor. MacKenzie injects 1 pound of compressed gas per cubic foot of tile. When the gas displaces air in the lines (as indicated by sulfur odor at the outlet) he closes the outlet. After 24 hours, he flushes the lines with water.

The scientists close drain outlets before they use sulfuric acid and sodium bisulfite. Then they introduce the chemicals, plus water, through a pipe inserted at the upper end of the line. Amounts of the chemicals are adjusted to make a solution containing 0.3-percent sulfuric acid and 2-percent sodium bisulfite.

### Chemical mixture forms sulfur dioxide

These chemicals react to form sulfur dioxide, which dissolves manganese and iron deposits. The dissolved deposits are easily flushed out with water after 24 hours.

Cost of the treatment with sulfuric acid and sodium bisulfite is $3 to $5 per acre for systems with 4- or 5-inch laterals spaced 350 feet apart. This treatment requires considerable labor and careful metering of chemicals. Consequently, it has not been widely adopted by farmers.

Since development of the easier sulfur dioxide gas method, farmers are becoming interested in treating tile lines. Costs of the two treatments now are about equal, but large-quantity purchase is expected to reduce cost of the gas treatment.

In earlier investigations, ARS scientists tested several chemicals that dissolved manganese and iron deposits, but the chemicals were too expensive for field use.

Scientists do not yet know the causes or methods by which the minerals are transferred from soil to the drainage lines. They think chemical and microbial processes are involved. Research is underway to learn how and why the deposits occur.

Meanwhile, chemical treatments every 4 or 5 years should keep detrimental effects of iron and manganese deposits at a minimum.☆

*Sulfuric acid and sodium bisulfite method requires careful metering of materials. Scientists inject concentrated sulfuric acid from drums, sodium bisulfite from a tank, and water into the lines.*

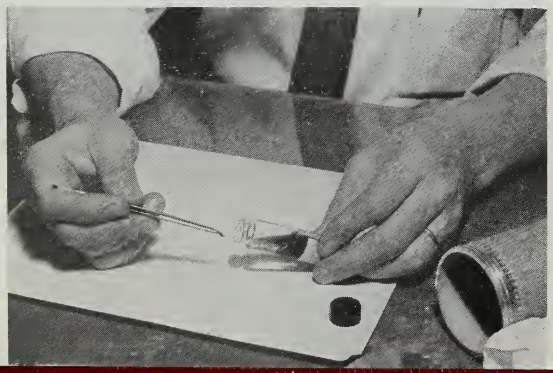
*Less equipment is needed for the sulfur dioxide method. Compressed gas is injected directly into the drain. After 24 hours, the dissolved deposits can be flushed out with water.*

# MANY USES FOR . . . *Insect Collection*

*Weevils in this collection came from such faraway places as Manchuria and Mongolia.*

*There is a proper place for every one of some 14 million specimens in the collection at the Smithsonian.*

*An ARS taxonomist takes newly arrived specimens from a shipping vial.*



*Important identification and information services are provided by taxonomists doing research in Washington, D.C.*

More than 14 million specimens of insects from all parts of the world are housed in a collection in the Natural History Museum of the Smithsonian Institution in Washington, D.C. Some 400,000 species, believed to be 40 to 50 percent of all described insects, are represented.

Two of the main purposes of maintaining and increasing this collection are to provide identification services and to obtain and catalog such data as distribution of insect species and insect biology. To avoid the possibility of error, it almost always is necessary to know the exact identity of an insect before extensive—and expensive—control measures are taken against it. Federal, State, commercial, and private agencies—and the general public—have learned how essential it is to have this information.

And in conducting research, scientists in most parts of the world make use of the data and identification services provided by the staff of 28 ARS and Smithsonian entomological taxonomists.

The National Museum houses the collection, provides custodial services, and office space. ARS furnishes the majority of scientists who work on the collection.

This insect collection is the largest in the Western Hemisphere; one of the largest in the world. Of 330,000 specimens received for identification in 1961, about 73,000 were added to the permanent collection, says J. F. Gates Clarke, the Smithsonian's curator of insects.

Insects for identification come from various sources. Some come directly from farmers and householders. Many are sent in by researchers of various State agricultural and health organizations. Others are received from U.S. agencies working to improve agriculture and health in foreign countries. Thousands come from foreign governments needing insects identified but lacking personnel trained in this work. Large numbers are submitted by research and regulatory personnel in USDA and other Federal agencies.

An incident that began in a backyard in Coral Gables, Fla., in April 1956, is one of the best illustrations of why insect identification is so necessary.

A Coral Gables homeowner cut open a home-grown grapefruit and found it infested by fly maggots. The homeowner took the infested grapefruit to the Dade County agricultural agent, who sent it to the State agricultural experiment station. From there, larvae of the insect were sent to an ARS taxonomist at the Smithsonian in Washington.

Four days after the homeowner found the infested fruit, specimens of the larvae reached R. H. Foote at the Smithsonian's National Museum. Foote identified the larvae tentatively as the Mediterranean fruit fly. Meantime, a State entomologist in Florida had gone to Coral Gables and reared adults of the fly. Seven days from the time the larvae were found, Foote also had adult specimens of the insect pest and these made a positive identification possible.

Based on the sole word of this taxonomist, a $10 million eradication program immediately was started by State and Federal agencies. This campaign was completed successfully before the pest spread to the main commercial citrus groves of central Florida, and to other citrus-producing areas of the country.☆

# Does Pear Decline Affect Canning Quality?

■ Is slow decline a primary cause of uneven or dark color in canned pears? Does poor canning quality result directly from this mysterious disease that causes trees to lose vigor, yield less and less, then die?

Apparently not, according to USDA and State scientists at Prosser, Wash. They determined, however, that pears from trees infected with slow decline may contribute to off-color in the canned product.

By comparing canned Bartlett pears from healthy and diseased trees, the researchers discovered that:

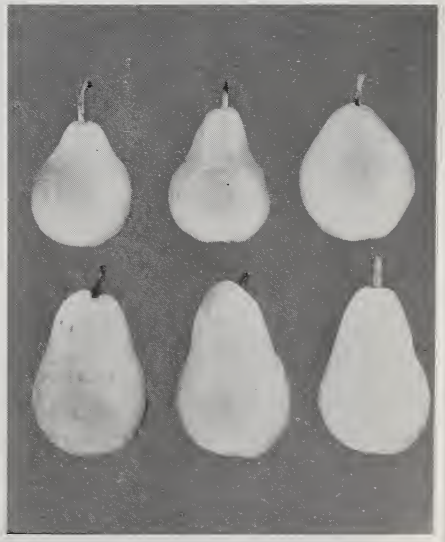
- Variations in tannin content and color occur in pears from healthy and infected trees. (Off-color was associated with a high content of tannin.) Tan and brown colors were observed in canned pears from healthy and declining trees, although these colors were seen more in canned fruit from affected trees. Pears from diseased trees often appeared to be more mature at harvest (had more yellow and pink blush colors) than fruit from healthy trees.
- Fruit from declining trees was as firm as fruit from healthy trees harvested at the same time. But fruit from the infected trees was shorter, slightly smaller in diameter, and frequently more off-shaped than pears from healthy trees.
- Pears from diseased trees were ready for canning after the same storage and ripening treatments given pears from healthy trees. Fruit from affected trees was slightly firmer than pears from healthy trees at canning time.

These studies were conducted by ARS chemists D. W. Ingalsbe, G. H. Carter, and A. M. Neubert of a field laboratory of the Western utilization division, Albany, Calif. They worked with plant pathologist E. C. Blodgett of Washington's Irrigation Experiment Station, Prosser.

The scientists believe studies of soil condition, cultural practices, and other variables in production may help determine factors that contribute to high tannin content of pears and poor color after the fruit is canned.

Slow decline has been linked to death of sieve tubes (food passages) in rootstocks just below the bud union, where rootstock and fruiting stock are grafted together. This sieve-tube injury keeps carbohydrates from being translocated to the roots. They die and trees decline (Agr. Res., October 1960, p. 14).

Decline develops slowly during several years or rapidly in a few days. Pear growers have suffered substantial losses due to this condition.☆



*Pears (top) from the infected trees are of different size and shape than fruit (bottom) from healthy trees.*

*Corn loss from harvesting with header attachment on this self-propelled combine was only 3½ percent in 1961.*

*This mechanism (with protective shield off) directs the plants into combine, where ears are cut from stalks and shelled.*

# Attachment Makes Combine a Corn Picker

*The conversion operation can be done in only a few minutes*

*Two header units mounted on a large combine will harvest corn from four rows. This one, however, is being used to harvest sweet sorghum seed.*

■ An inexpensive header attachment for converting a grain combine into a corn picker has been developed by engineers of USDA and Clemson (S.C.) Agricultural College.

The attachment was developed mainly for farmers who want to harvest a small acreage of corn, but cannot justify the expense of a corn picker or a standard attachment for a grain combine. A heavy-duty header attachment is available for converting a combine to a corn picker, but is considerably more expensive than the new attachment and is primarily for large-scale harvesting.

The new header is not yet commercially available, but some manufacturers have shown an interest in it.

Converting a combine into a corn picker takes only a few minutes. The combine gathering reel is removed and the header attachment is installed in its place. Three bolts hold the 200-pound unit in place. Two units can be attached to large combines.

The header was developed by agricultural engineers J. K. Park of ARS and B. K. Webb of Clemson.

A series of disappearing fingers direct corn plants into the combine where the ears are cut from the stalks and shelled. In 2 years of testing at Clemson, the header attachment was used very successfully. For example, corn ear losses in 1961 were 3½ percent in all fields harvested—only slightly more than losses when a standard header attachment or a corn picker was used. In fields of unlodged corn, losses were even less than 3½ percent.

The attachment also was used successfully to harvest soybeans, grain sorghum, sweet sorghum, and sweet sorghum seed in tests at Clemson. Sweet sorghum seed is usually harvested by hand.☆

# SIMPLE PROCEDURE INCREASES OAT SEED SET

■ Simple wetting and shading operations may hasten development of new oat varieties by helping breeders solve one of their biggest problems—low seed set in hand-pollinated oat crosses.

ARS agronomist H. G. Marshall has increased seed set with three cooling and humidification methods:

- Placing wet glassine or parchment bags over the grain heads.
- Shading wet bags with a canvas canopy.
- Shading dry bags with a canvas canopy.

Marshall conducted the investigations with associates at the Pennsylvania Agricultural Experiment Station, University Park.

In one experiment, an average of 51 percent seed set occurred in hand-pollinated oats covered the conventional way with dry bags and no shade. This is a relatively high seed set, and indicates that conditions were favorable.

However, all three cooling and humidifying methods gave a big increase in seed set. In grain heads covered with wet bags, seed set was 87 percent. Where dry bags were shaded, seed set was 84 percent; where wet bags were shaded, it was 91 percent.

Increased seed set is attributed to the creation of conditions similar to the natural conditions that exist for self-pollination of the oat. Self-pollination in each oat flower takes place naturally in a closed chamber containing the stamen and pistil.

Transpiration by the plant and droplets of moisture on the inside of each flower chamber provide proper conditions for fertilization.

When pollinating is done by hand, the delicate plant parts that form the flower chamber are separated and often damaged. Then high temperatures and low humidities dry the pistil and inactivate the pollen, preventing fertilization.☆

# VALUABLE PARENTS FOR CASTORBEANS

■ Two breeding lines that may be useful as inbred female parents for producing hybrid dwarf castorbeans have been developed by USDA scientists working with the Texas and California Agricultural Experiment Stations.

The lines, TSP–10 and CNP–1, have a characteristic needed by commercial producers of hybrid castorbeans—a high percentage of the plants bear *only* female flowers in U.S. locations. In experiments, 94 percent of the TSP–10 plants produced only female flowers; 50 percent (high in castorbeans) of the CNP–1 flowers were female.

Normally, castorbean plants bear male and female flowers on the same spike. Removal of male flowers to develop hybrids from such parent stock is impractical.

Actually, breeders rogue (destroy) any plants with male flowers in making the final cross to produce hybrids. This roguing is time-consuming and expensive. Previous breeding lines had a smaller proportion of female-flowering plants, and consequently they required much roguing.

Seed of the two new lines has been made available to commercial seed companies. When used with desirable male lines in hybrid combinations, the new lines should contribute increased yield, disease resistance, and favorable growth characteristics. TSP–10 and CNP–1 will be crossed with various male lines in efforts to breed hybrids adapted to specific production areas.

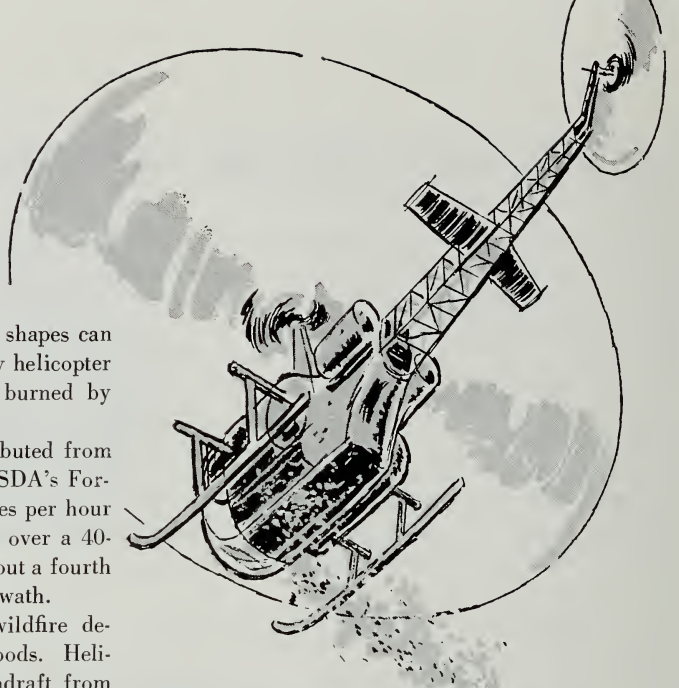
Both new lines are dwarf-internode (short stalk) castorbeans suited to machine harvesting.

ARS agronomist R. D. Brigham developed the TSP–10 line at College Station, Tex. He started this work by using a mutation—a spontaneously occurring female-flowering plant.

By extreme selection, involving removal of off-type plants every 2 days during the growing season, he developed the line. It was tested 3 years at Plainview and Lubbock, Tex., where 94 percent of the plants produced only female flowers throughout the growing season.

CNP–1 resulted from a cross between a dwarf-internode castorbean breeding line and a line carrying a genetically stable recessive gene for female flowering. This line was developed by ARS agronomists L. H. Zimmerman and J. W. Vaccaro at Davis, Calif. After four generations of brother-sister mating to purify the line, they developed a breeding line in which approximately half the plants produced female flowers only.☆

# Seeding Burned Watersheds by HELICOPTER



*Here is an efficient way to produce temporary cover to keep water runoff from causing flooding and erosion*

■ Grass and herb seeds of different sizes and shapes can be combined in various mixtures and sown by helicopter to establish temporary cover on watersheds burned by wildfire.

Seeds in a number of mixtures were distributed from the air in tests by range conservationists of USDA's Forest Service. The helicopter flew about 45 miles per hour 50 feet above the ground. Good distribution over a 40-foot swath was obtained in all the tests. In about a fourth of them, coverage was good over a 50-foot swath.

Reseeding forest watersheds soon after wildfire destroys natural cover is important to prevent floods. Helicopters are particularly useful, because downdraft from the rotor forces seeds into close contact with soil, facilitating rapid germination.

Helicopters are efficient and comparatively safe for sowing seed in mountainous areas. They can fly at low speeds near the ground and maneuver to permit precise coverage of corners and hard-to-reach areas.

Cost of sowing a 13,496-acre burned area—exclusive of seed and seed mixing—was $2.00 per acre for areas of 2 to 26 acres, $1.50 for areas of 26 to 103 acres, and $1.00 for areas averaging 254 acres.

The researchers tried 17 plant species, in combinations, in the San Dimas (Calif.) Experimental Forest.

The work was done by G. C. Edmundson, L. R. Green, and J. R. Bentley of the Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

Large, chaffy seeds of wheatgrasses were spread less than seeds of small-seed species such as Hardinggrass, smilo, big bluegrass, and orchardgrass. Medium-sized seeds—of ryegrass, tall fescue, and Blando brome—were spread as widely as the small-seed species.

A flight course was laid out along a bulldozed trail on a ridge-top. The quarter-mile course had sampling stations every 300 feet. There were seed-catching plates in the center of the course and at intervals of 10 feet out to each side.

Light wind caused a consistent downwind shift of the entire swath. In large-scale sowing in the forest after the tests, flying was stopped when wind velocity reached 10 miles per hour.☆

## Safflower line resists diseases

A new safflower line developed by USDA and the Utah Agricultural Experiment Station provides breeders of this oilseed crop with a source of resistance to rust and root rot.

Greatest advantage of the new breeding line, U–1421, is its resistance to the two common strains of Phytophthora root rot and to all races of rust (*Puccinia carthami*) known to occur in the U.S. Root rot and rust usually are prevalent where surface irrigation is used on safflower.

No present commercial safflower variety has good resistance to both of the two common strains of Phytophthora root rot. A high oil content and good agronomic characteristics also make U–1421 a desirable line.

The new line is a selection from a cross that was made at the Agricultural Research Center, Beltsville, Md., in 1955. In 1959, U–1421 was selected at Logan, Utah. It has been tested since then in the field at Logan and other locations, and in the greenhouse at Beltsville. ARS scientists in charge of investigations were plant pathologist C. A. Thomas at Beltsville and agronomist L. N. Leininger at Logan.

Safflower oil is used in paints and varnishes. Food industries are increasing their demands for the oil, because it contains much linoleic acid and unsaturated fat.

## Wood formation studies underway

Basic research on the formation of wood in forest trees is underway in a new USDA pioneering research laboratory in Rhinelander, Wis.

Scientists there will try to develop basic understanding of the physiological processes that control the growth and differentiation of wood elements in the trunks of forest trees. The research will explore three main areas: hormonal regulation of wood formation, source and action of hormonal stimulus, and other factors involved in wood formation.

Forest Service plant physiologist P. R. Larson will head the new laboratory housed at the Lake States Forest Experiment Station in Rhinelander.

This pioneering laboratory is the 19th set up by USDA since 1957 to explore beyond the known limits of scientific knowledge.

## Even a few weevils can be a hazard

Boll weevil females can mate in the fall and produce offspring from eggs laid the next spring, USDA and Texas entomologists have learned.

This discovery points up the possibility of a new infestation getting started from even a small weevil population in the spring.

Before this finding, scientists assumed that if only a few weevils survived winter in a given area, there

would be few opportunities for mating and little or no egg hatch.

In November 1960, entomologists L. G. Pickens of ARS and J. K. Walker of the Texas Agricultural Experiment Station collected 300 female boll weevils. They were placed in small screen-wire containers to isolate them from the male insects. The containers, each holding three female weevils, were buried in ground trash to a depth of about 5 inches.

In March 1961, the hibernating weevils were recovered. Seventy of the insects survived, although many were weak. Two weeks later, 34 of the 70 were still living and each was placed in an individual glass vial for observation.

Eggs were deposited by 29 of the 34 females, and about 91 percent of the eggs hatched.

## New tillage laboratory buildings

Indoor tillage tests on a large scale will soon be possible in USDA's National Tillage Machinery Laboratory, Auburn, Ala.

Construction is underway on a laboratory-administration building and on one to house two large soil bins. Completion of the $300,000 addition is expected next December.

The laboratory - administration building will bring under one roof laboratories and offices now in three buildings. Scientists in two of the laboratories will investigate the physical and mechanical properties of soils and how the physical condition of soil affects plant growth. Agricultural engineers in a third laboratory will test model tillage tools.

The new laboratory-administration building (nearly 10,000 square feet of floor space) will house a conference-reading room, drafting room, darkroom, and offices for a staff of 15.

The other new building (about 14,000 square feet of floor space) will contain two 20- by 200-foot soil bins that will permit tillage research any time of year. There are now nine outdoor soil bins of about the same size. Those in use have to be covered during rainy weather, causing delays in the research.

ARS agricultural engineer A. W.

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Cooper is director of the tillage laboratory, established in 1935. Researchers there test model and full-sized tillage, transport, and traction equipment in various types of soil. The object is to improve equipment and tillage operations.

## Research aim is better reservoirs

More efficient water reservoirs for livestock in the Northern Great Plains should result from USDA research in western South Dakota.

ARS scientists hope to develop better procedures for estimating runoff from rangeland watersheds. Such research will provide improved guidelines for USDA's Soil Conservation Service and others in determining the storage capacity and spillway requirements for farm and ranch stock ponds and small reservoirs.

In addition, the researchers are collecting information on sediment yields from watersheds with sandy and

clayey soils. They hope to develop a way of predicting sediment accumulation in Northern Great Plains reservoirs.

Both runoff and sediment estimates will be based on data being collected on 16 grassland watersheds near Newell, S. Dak. These watersheds have been equipped with automatic devices to measure water yield and reservoir losses.

Sediment measurements will be made every 4 years, or as required after heavy runoff.

The research is a part of a nationwide effort to learn more about watersheds, so that water can be conserved and flood damage prevented. Results will apply directly to 104 million acres in North Dakota, South Dakota, Montana, and Wyoming.

ARS hydraulic engineer J. W. Neuberger and botanist A. R. Kuhlman are cooperating with the South Dakota Agricultural Experiment Station in this research.

## Overhang is featured in new plan

A roof overhang that shades southern-exposure windows in the summer, but lets winter sunlight in, is one of the key features of a newly revised USDA-California plan for building a farm cottage.

Design of the overhang depends on height of windows and geographic location. For example: if the bottom of the window glass is 4 feet below the eaves of a house on the 35th parallel, a 34-inch overhang will keep out sunlight in summer, yet admit some in winter.

Data for figuring the amount of overhang needed in other latitudes and for other window heights are included in the plan. The data, developed by a University of California agricultural engineer, also may be adapted to designs for other houses.

Although the design by ARS architects and housing specialists is for a farm cottage, the plan can be used in building a suburban home, a beach or vacation cottage, or a home for a retired couple.

The cottage is well suited for occupancy by a young couple starting in farming. As the business expands, the couple can build another house and use the cottage as a tenant house.

Living, kitchen-dining, and sleeping areas and a bath supply 468 square feet of space in the cottage. An additional 294 square feet of space is provided by two porches and a storage area.

The dining area, large enough to accommodate six persons, adjoins the living area and is well lighted through a window wall. Special space-saving features include an undercounter water heater, pullout bed, wall desk, wall-type heater, and accordion-type closet doors.

The cottage is constructed on a concrete slab. ARS architects say concrete-slab construction can be used

in most areas, except where the site is very low and poorly drained.

Working drawings of this farm cottage (Plan No. 7148) are available from extension agricultural engineers at most State agricultural colleges. There is usually a small charge.



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